Digitization and The Commander: Planning and Executing Military Operations

A Monograph

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14. ABSTRACT

Since the development of Industrial Age armies, the battlefield has increased in complexity and uncertainty. This is the result of tactical units dispersing on the battlefield for protection from increased weapon lethality and the need to sustain and maintain increasingly sophisticated and capable tactical units. Beginning in the early 1990s, the U.S. Army began a Revolution in Military Affairs (RMA) to integrate information technology into tactical units. The RMA integrates information technology (computer and communications) developed by the civilian sector to assist the tactical commander in his ability to command and control subordinate units in combat. The purpose of digitization is to use a technological method to maintain the Army?s asymmetric advantage in command and control over other armies. This monograph asks the question: Can communication, automation and information technology (digitization) reduce the complexity and uncertainty for the commander and will it support his future decision-making? The monograph looks at technology as a reoccurring method used by military organizations to assist the commander in making timely decisions on the battlefield. The use of computers and communication networks to establish an information system (C4ISR) links the sensor to the decision-maker to the executor to make tactical units more efficient and effective on the battlefield. This monograph shows merit in the digitization of tactical units to reduce complexity and uncertainty in planning and executing tactical missions. The digital systems provide the commander, his subordinate commanders and staff the data and information to plan and execute in a more certain environment. The system providing the information allows the commander and his subordinates to concentrate on the analysis of the information instead of searching for data and displaying it in a useful manner. This monograph also concludes that the methods of how a commander focuses his staff and commanders are still valid based on the current doctrine for planning and executing missions. The digital system is an enabler that requires training by the commander and his unit to fully leverage the speed of the microprocessor. This enabler permits the commander to visualize, describe and direct the actions of his unit on the battlefield.

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Abstract

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Since the development of Industrial Age armies, the battlefield has increased in complexity and uncertainty. This is the result of tactical units dispersing on the battlefield for protection from increased weapon lethality and the need to sustain and maintain increasingly sophisticated and capable tactical units. Beginning in the early 1990s, the U.S. Army began a Revolution in Military Affairs (RMA) to integrate information technology into tactical units. The RMA integrates information technology (computer and communications) developed by the civilian sector to assist the tactical commander in his ability to command and control subordinate units in combat. The purpose of digitization is to use a technological method to maintain the Army's asymmetric advantage in command and control over other armies.

This monograph asks the question: Can communication, automation and information technology (digitization) reduce the complexity and uncertainty for the commander and will it support his future decision-making? The monograph looks at technology as a reoccurring method used by military organizations to assist the commander in making timely decisions on the battlefield.   The use of computers and communication networks to establish an information system (C4ISR) links the sensor to the decision-maker to the executor to make tactical units more efficient and effective on the battlefield.

This monograph shows merit in the digitization of tactical units to reduce complexity and uncertainty in planning and executing tactical missions. The digital systems provide the commander, his subordinate commanders and staff the data and information to plan and execute in a more certain environment. The system providing the information allows the commander and his subordinates to concentrate on the analysis of the information instead of searching for data and displaying it in a useful manner. This monograph also concludes that the methods of how a commander focuses his staff and commanders are still valid based on the current doctrine for planning and executing missions. The digital system is an enabler that requires training by the commander and his unit to fully leverage the speed of the microprocessor. This enabler permits the commander to visualize, describe and direct the actions of his unit on the battlefield.

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PREFACE

"The goal is to create a general purpose combat force that is capable of dominance across the spectrum of operations, from stability and support operations to major theater war, in all environments from open and rolling to complex terrain and, equally important, transitioning between operations and environments without operational pause."

TRADOC PAMPHLET 525-5 Force XXI Operations (DRAFT) 1

The United States Army is an increasingly complex organization that requires large amounts of information to function efficiently. In July 2000, *Army Magazine* published an article by General Paul F. Gorman; USA Ret. entitled "The Defense of Fombler's Ford."2 The article looks into the future and at the potential of a tactical unit conducting independent operations in a peace enforcement operation. The unit is equipped with several Future Combat Systems (FCS) that rely on digital communications, robotics and automated information systems to accomplish the mission of defending Fombler's Ford. General Gorman borrows from *The Defense of Duffer's Drift* to present Back Forethought VI with a series of dreams to illustrate the increased potential of a "digitized force" in comparison to a traditionally equipped force. The computer network allows Captain Maltzoff to command and control his company of approximately 30 men by viewing a computer screen in his command post. Without human interface or requests the automation network ensures the company and the command post receive

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1 Department of the Army, *TRADOC PAMPHLET 525-5 Force XXI Operations (DRAFT)*, (Washington D.C.: GPO, 26 October 2000) page 2-7.

2 Paul Gorman, "The Defense of Fombler's Ford," *Army Magazine*, July 2000, pages 27-40. Available at http://cpof.ida.org.

supplies and continuous updates on the enemy, the status of the friendly force and where and when any contact with the enemy occurs. This is a possible view of the potential that the integration of automation technology for command and control brings to tactical level warfighters.

Since the end of the Gulf War in 1991, the United States Army embarked on a Revolution in Military Affairs (RMA) or a Military Technical Revolution (MTR).[3] This revolution integrates the improvements in weapons technology of range, lethality and numerous other physical factors with automation and information technology developed by the civilian sector. This automation and information RMA has several goals. The first is to expand the battlespace that the tactical commander will conduct military operations through the increase in the flow of data available through automation. The second is the increase in data that will allow a commander and his staff to synchronize and conduct multiple tactical operations or tasks simultaneously or near simultaneously in this larger battlespace. The third is the automated information network that allows the commander to mass his force for shorter periods and enable a greater effect in time and space by elements conducting fire and maneuver. Finally, this technology will accomplish these goals because the systems supporting this flow of data will reduce the complexity and some of the uncertainty the commander faces on the modern battlefield.

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[3] Department of the Army, *TRADOC PAMPHLET 525-5 Force XXI Operations*, (Washington D.C.: GPO, 1 August 1994) page 2-7.

INTRODUCTION

"An Military Technical Revolution (MTR) occurs when the application of new technologies into military systems combines with innovative operational concepts or organizational adaptation to alter fundamentally the character and conduct of military operations."

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Historically, the introduction of technology has increased the ability to command and control a military force. The commander's ability to command and control his forces over an increasingly larger and dispersed battlefield is the result of technology introduced with the coming of the Industrial Age. Beginning with the telegraph, followed by the radio and today with the integration of automation and information technology (digitization), the ability to receive data rapidly and employ forces on the battlefield is revolutionizing tactical warfare. This reliance on technology is the result of increased communication and information needs associated with the mechanization of the modern battlefield. Digitization is the latest effort by technology to limit the effects of increased complexity and uncertainty brought about by mechanization.

Can communication, automation and information technology (digitization) reduce the complexity and uncertainty for the commander and will it support his future decision-making? The "digitized unit" with its network of automation and information systems is capable of receiving large amounts of data. To reduce the complexity and uncertainty on the battlefield and provide a common operational picture for decisions, the commander requires relevant information or

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4 *TRADOC PAM 525-5 Force XXI Operations*, page 2-8.

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knowledge. The automation and information systems provide the data is the foundation for the relevant information the commander needs to make timely decisions. The information system provides data to the commander and his staff, to conduct the constant analysis to synchronize the tactical fight. The use of automated and informational technology has the potential of taking the commander and the battle staff in two directions.

The first is the automated information network that will provide the commander the common operating picture and the analysis of the data instead of the staff. The staff will become the facilitator of the network ensuring that connectivity or constant flow and correctness of data are present. This task will provide the commander the relevant information or knowledge and the common operational picture he and his subordinate units require making decisions to fight a battle. This is the example presented by General Gorman in his article "The Defense of Fombler's Ford."

The alternative is a modification of the traditional duties and responsibilities of the staff as described in *FM 101-5 Staff Organization and Operations*. 5 The staff will continue its analytical role but will use the automated informational network as an enabler. The network will assist the staff in developing and disseminating the common operational picture and relevant information to the commander and his subordinates, but the staff will analyze the data on the network. The staff as an additional duty or task will ensure connectivity, flow and accuracy of data while still conducting its traditional role.

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5 Department of the Army, *FM 101-5 Staff Organization and Operations*, (Washington D.C.: GPO, 31 May 1997) pages 5-1 through 5-31.

In both cases, the analysis and dissemination will occur at a higher rate allowing the commander to make decisions more rapidly and maintain a higher level of tempo for operations relative to the enemy. This enhanced ability of the staff is the key to reducing some of the complexity and uncertainty of military operations in the future.

This monograph will show that the introduction of technology in military organization is not a new event. New technology requires the introduction of organizational and procedural changes to conduct military operations throughout the ages. However, the changes and effects of the new technology are usually evolutionary not revolutionary. The first chapter will discuss the role and impact of technology as a way to enhance the ability of the commander to command tactical units and control military operations by attempting to reduce the complexity and uncertainty on the battlefield. Finally, this chapter will define and show that the staff became necessary to assist the commander to reduce or manage the complexity and uncertainty on the battlefield.

The second chapter will discuss the relationship between the commander and his staff. The focus is on the products and guidance the commander provides the staff. The chapter will also discuss the duties, responsibilities, analytical and the informational functions that the staff accomplishes to assist the commander during the planning process and during the execution military operations. The reader will understand the role of a commander's vision and intent that he produces or presents to focus the staff to assist it to synchronize, develop, produce a written order and execute the mission. Finally, the reader will

understand how digitization reduces the complexity and uncertainty of the battlefield by providing relevant information and a common operational picture to the commander. The study will illustrate that the commander's ability to make timely decisions is the result of the integration of a common operational picture and analyzed data by the commander and the staff. Finally, the monograph will show that integration is a continual event as constantly changing or updated data is presented to the commander and his staff and is the basis of the commander's ability to make timely decisions

The third chapter will discuss why the U.S. Army is integrating the use of automated information technology (referred to as network centric warfare) into the force. What is the potential effect on the reduction of complexity and uncertainty in military operations? The reader will understand potential capabilities of an automated informational system to provide the commander and his supporting staff a common operational picture and relevant information on the battlefield. The analysis will focus on the ability of the system to reduce complexity and uncertainty relative to a friendly force, an enemy force and the effects of terrain on both forces.

CHAPTER ONE:

TECHNOLOGY AND REVOLUTIONS IN MILITARY AFFAIRS

"Mere technological improvements do not constitute an MTR: in 1940, tanks, improved aircraft designs, and radios were available to both the French and Germans. However, it was the Germans who adapted their organizations, procedures, and tactics to transform the trench warfare of World War I into the blitzkrieg."

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Carl von Clausewitz in *On War* states that military organizations are an instrument of political power. That conduct of military operations or campaigns is to impose your will over another nation with force. 7 To conduct a successful military operation or campaign the commander and his staff must solve a series of complex problems. The ability of the commander and his staff to solve these has become more complex and difficult as the nations and their armies have evolved though history. To solve problems, military organizations have relied increasingly on the use of technology to command and control their forces as they attempt to impose their will on the enemy. According to *ST 3-0 Operations*, technology is enhancements of the ability of the leader, unit and soldier to plan, prepare, execute and continuously assess while conducting military operations.8 This enhancement is usually through artificial means by giving soldiers and leaders the ability to conduct a military task better relative to the enemy. In this

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6 *TRADOC PAM 525-5 Force XXI Operations*, page 2-8.

7 Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret, (Princeton: Princeton University Press, 1984), page 75.

8 Department of the Army, *ST 3-0 Operations*, (Washington D.C.: GPO, 1 October 2000) page 1-12.

case, the ability to command and control formations of men and equipment on an increasingly dispersed battlefield. The use of technology is not a new event. During each period of social revolution (agricultural, industrial and informational), the changes in society and its associated technology have allowed armies to reach further, faster and with greater effect.9

The Agricultural Revolution (The Age of Tools) 10

During the Agricultural Revolution, the ability of the city or nation state to wage war was the result of the wealth gained through the improvements in agriculture. Agricultural wealth gave rise to the ability to establish permanent settlements. These settlements allowed communities to produce and store a surplus of food (economic wealth). This surplus of food, in a single location, was at the disposal of a single authority or government. This economic wealth not only allowed communities to conduct warfare, but it also provided a goal to conquer in the war. As this authority became wealthier, the ability to support a larger and better-equipped army led to a series of revolutions in military affairs in organization, logistics, administration and leadership styles. 11

During the Agricultural Age, campaigns were short, usually the summer months, since the soldiers had to return to harvest the crops in the autumn.

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9 Alvin and Heidi Toffler, *War and Anti-War: Survival at the Dawn Of the 21st Century*, (New York: Little, Brown and Company, 1993), page 30.

10 Martin van Crevald*, Technology and War: From 2000 B.C. to the Present*, (New York: The Free Press,1989), pages 9-67.

11 Tofflers, *War and Anti-War: Survival at the Dawn Of the 21st Century*, pages 33-37.

Normally, two armies came together at a mutually agreed location and fought a single battle that decided the outcome of a campaign. The size of the battlefield was physically small enough that commander was able to see his entire force; simplifying his ability to command and control his force. Command was through personal presence and control relied on the use of sub-units, dispatches to subordinates and visual and audio aids.

The standardization of sub-units put a group of soldiers under the command of an individual subordinate commander. Initially, nationally or the type of combat arm (i.e. infantry, cavalry and artillery) divided these sub-units. By the time of the Napoleonic period, these sub-units evolved into groups that contained all arms on the battlefield. This organizational evolution allowed the overall commander to control individual subordinate commanders instead of a single large mass of men. The use of dispatches allowed the commander to commit and motivate his subordinate forces and allowed subordinates to report to the commander on their status during the battle. The technology of command and control was simple and could rely on visual and audio means because of the limited size of the battlefield. The visual and audio aids had several functions for the military force.

First, these aids allowed the commander to assess the conduct of the battle by seeing the location of the unit's standards or colors. He could personally intervene at any location of the battle if he felt that some part of his army was faltering under the strain of combat. Secondly, the common soldier could identify his leaders, fellow soldiers of his unit (through unit colors and standardized

uniforms) and friendly units to his left and right (again through unit colors and standardized uniforms). This affected his morale by allowing the individual soldier to see how well or poorly the battle was going without the personal intervention of his commander to reassure him. This allowed the commander to indirectly control his army. The use of the drum, whistle, trumpet and bands were all methods used by commanders to control when a force would advance, withdrawal or charge in battle.12

The slow but continual introduction of technology during this period permitted the armies to fight with increased efficiency, better organizations, and an enhanced logistic capability and with greater destructive effect. Physical shock and fires between two armies in a small area or single point characterized warfare. This allowed the commander to command and control the army by his physical presence. Even the large armies of the Napoleonic wars, especially during the campaigns of 1813 and 1815, the outcome and conduct of the battles were influenced directly by the commander, Napoleon. 13

The character of warfare saw the commander as his own chief of staff and the central processor of the information from his small staff and subordinate commanders. Even with the introduction of the corps organization during the Napoleonic period, the overall army commander exercised a high level of personal control over these large units. The staff aided the commander by

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12 Sun Tzu, *The Art of War*, trans. Samuel B. Griffith, (New York: Oxford University Press, 1963), pages 90-91 and 106-107.

13 Martin Van Crevald, *Command in War*, (Cambridge: Harvard University Press, 1985), pages 65-68.

facilitating the flow of information between the commanders through dispatches and reports dictated to the staff members by the commander himself. 14

The Industrial Revolution (The Age of Machines and Systems) 15

During the Industrial Revolution, the rapid introduction of new technology in weapons, transportation and communications took the simpler armies of the Napoleonic Period and transformed them into complex organizations that required more information to function effectively. The need for a faster and more efficient flow of information increased as machines and the systems to support them replaced the muscle power of the pre-industrial armies. Industrialization allowed nations to sustain armies for longer periods of time and over greater distances. Initially, machine age technology's greatest impact was in an increase in lethality brought about by the new weapons technology. Military forces began to disperse on the battlefield to increase their survivability. 16 The commander's ability to command and control forces became limited as the battlefield became larger and emptier. This dispersion led to changes in the organization and tactics of fighting units. These changes required an increase in the information necessary to effectively command and control these units.

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14 Trevor Dupuy, *The Evolution of Weapons and Warfare*, (Virginia: Hero Books, 1984), page 160.

15 Crevald, *Technology and War: From 2000 B.C. to the Present*, pages 9-67.

16 James Schneider, "The Theory of the Empty Battlefield." *RUSI: Journal of the Royal United Services Institute for Defence Studies* (Sept. 1987), pages 37-44.

The dispersion of forces did not allow the commander to command and control his army through his physical presence. The commander could not simply gaze out across the battlefield and see what was happening; he required information to fight a battle and his physical presence at a particular place became less important and at times irrelevant. The subordinate commander became the source of information for the commander during the execution of the battle. The science of command diminished in importance and the art of command became dominant.

The art of command consists of two fundamental abilities. The first is to "visualize" his force and the battlefield in its present state and then mentally project into the future to a desired endstate in terms of time and space. This involves being able to describe and direct the method or plan his force will use to achieve his desired endstate. 17 Information is necessary for visualization, not the commander's physical presence. The second, is the ability of the commander to communicate his method and endstate to his subordinate commanders verbally, either in person and in writing.

The need for increased amounts of information due to dispersion and the increasingly protracted nature of modern warfare has led to more layered, complex and adaptive military organizations. Social scientist studying complex organizations and how they use information define it as a system of interrelated systems the more systems acting together the more complex the organization. Mitchell Waldrop in his book *Complexity* states that an adaptive and complex

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17 Department of the Army, *ST 3-0 Operations*, pages 5-2 through 5-6.

organization must follow these concepts:

- Many 'agents' acting in parallel.

- Highly dispersed control system.

- Many levels of organization.

- The ability to anticipate the future through the process of learning,
  evolving and adapting. 18

The key to a complex military organization is its ability to acquire and use

information. Technology enhances that ability.

According to Dr. James Schneider Ph.D. of the School of Advanced Military

Studies, military organizations use information in five ways. 19 The first is to use

information to describe itself and the enemy and the relationship between each

other before, during and after the battle. The changes in the organization and

the layering of forces, both friend and foe, made this information requirement the

focus for the commander and his staff. Today having this information gives the

commander situational awareness or a common operational picture. Second, the

echelons of units use information to organize themselves for combat. The

dispersion of military organizations for self-protection creates a requirement for

more information and the need for organizational structures to receive and

process information. Third, the complexity of military organizations increased the

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18 M. Mitchell Waldrop, *Complexity*, (New York: Simon and Schuster, 1992), pages 145-47.

19 James Schneider, *Cybershock: Cybernetic Paralysis as a New Form of Warfare*, SAMS Military Theory Readings, (Fort Leavenworth, KS: U.S. Army Command and General Staff College, 1999/2000), page 6.

number of tasks and engagements that were required to conduct military operations. The layered military organization and its increase in efficiency due to technological innovations (machine power replacing muscle power) allowed tactical units to conduct multiple tasks simultaneously and at a more rapid pace. The layering of military organizations made them more survivable and capable in combat protracting the time needed to complete a battle or engagement. A single tactical engagement no longer decided a battle, just as a single decisive battle no longer decided wars. These factors led to an increase in the requirement for and the size of staff organizations to process the information for planning and executing a battle. Fourth, the ability to collect and receive information became more complex due to the increased dispersion of the battlefield. A commander and his staff had to articulate to subordinates the need for information and actively seek out information necessary to synchronize and execute the battle. This increased complexity resulted in greater amounts of paperwork and the need for the establishment of professionally educated military commanders and staffs. 20 Finally, the ability of the commander and his staff to direct and control military formations required receiving greater amounts of information faster than the pre-industrial age armies. The introduction of new technology allowed the commander and his staff to receive information faster. This in turn gave the commander the ability to direct or control the battle.

The messenger was not capable of moving information fast enough for the commander to direct a battle or for his staff to assist him in controlling the battle.

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20 Van Creveld, *Technology and War: From 2000 BC to the Present*, pages 236-7.

The need for increasing the speed to receive and disseminate information led to the separation of the message from the messenger. 21 Dispersion on the battlefield and the commander's loss of control resulted in the introduction of new communication technology. These communication devices allowed the message to travel at the speed of the electron rather than the speed of the messenger.

The first such innovation was the adaptation of the telegraph by the military as a means to command, by increasing control, of a military formation. 22 The commander could employ an information network to "control-by-wire" and link several command posts together with copper wire. By the beginning of World War One the command posts of corps, divisions, brigades/regiments and battalions were connected by wire to facilitate the flow of information and instructions. In concept, the linking echelons of command by telegraph wire and by 1900 the telephone line; the commander should receive information at a higher rate and send instructions rapidly to subordinates.

Initially, appearing valid this concept did not enhance the flow of tactical information. Instead, it limited the commander's ability at division and below to command and control his organization in two areas. First, the information network did not change the ability of the tactical commander (division and below) to receive or send information at a faster rate. 23 As late as World War II

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21 Schneider, "Cybershock: Cybernetic Paralysis as a New Form of Warfare," page 7.

22 Van Creveld, *Technology and War: From 2000 BC to the Present*, page 174.

23 Van Creveld, *Command in War*, pages 107-109.

commanders and units fighting a battle continued to send and receive information and reports by a human messenger or by some form of optical or acoustic means. The resulting time delay limited the ability of the higher commanders to make timely decisions or to influence the conduct of fluid tactical battles. The logistic requirements of the telegraph and telephone also limited the mobility of the command posts. This factor and the speed in the flow of information, led to battles becoming less mobile and contributed to the static warfare of the First World War. The integration of portable radios eliminated much of the time delay imposed by the physical and logistical constraints of the telegraph and the telephone. The integration did not fully occur until the end of World War II.

The command post is the second area that limited the ability of the commander to lead or command his organization. In *Technology and War*, Martin Van Creveld notes that because higher headquarters used the telegraph and telephone as their primary means to gather data and information, the subordinate commander tied themselves to their command post.   Command posts of the lower echelon commanders had to provide information to their higher headquarters by wire since it was faster than sending a messenger to the rear. To send orders or instructions to his subordinates the commander required that the lower units' commander remain at their command post. Commanders directed units; staff members were incapable or not allowed to direct units in the commander's absence. If the commander left the command post, there was no way for the unit to execute instructions until he returned to their location.

Because command posts located where the wire ended, in village or town close

to the fighting, they tended to locate several kilometers behind the fighting troops.

This distance limited the ability of the commander to exercise personal

leadership on the battlefield causing a gap to develop between himself and his

soldiers and further limited the ability of the soldier to keep their commander

informed during combat. 24 Commanders lost the ability to command by losing

touch with the realities of the battlefield and therefore, could not present their

higher headquarters with accurate information crippling the entire chain of

command's ability to influence the battle. Again, the integration of the portable

radio and the ability to send messages through the air instead of by wire helped

to eliminate this problem.

During the period between World War I and World War II, the mechanization

of armies and their increase in mobility required the use of radios. The radio was

the key to the success of tactical mechanized units to function effectively. The

ability of the commander and his staff to receive and analyze information and

then to develop and send orders rapidly became the foundation of mechanized

warfare during the Second World War. The commander and his staff using a

vehicle or man-portable radio eliminated the need for a human messenger. This

limited the need for a wire-based communication system while still maintaining

contact with his command post and higher headquarters. 25 The use of the

24 Van Creveld, *Technology and War: From 2000 BC to the Present*, page 174.

25 Heinz Guderian, *Achtung-Panzer*, Christopher Duffy, trans., (London: Arms and Armor Press, 1992), pages 11 and 197-198.

airwaves unencumbered, physically and logistically, the chain of command's ability to send information at the speed of the electron. The failure to adapt and integrate the radio into military organizations before and during World War II contributed significantly to failure on the battlefield during World War II. By not using the radio as the foundation of their tactical command and control system, commanders continued to stay in their command posts far from the front. The countries that integrated the radio into their command and control system gained a significant, asymmetric advantage over an enemy that did not.

An example is the defeat of the French 55th Infantry Division by the German XIX Panzer Corps at Sedan on May 13, 1940. The refusal of the divisional, regimental and battalion commanders to allow subordinate units, for reasons of security, to use their radios handicapped the division's ability to counter the German attack across the Meuse River. 26 The reliance on wire communication did not give the French the flexibility they needed on the battlefield. German artillery and air attacks easily cut the wire between the defending troops and the battalion and regimental headquarters. The result was that the commanders quickly lost their ability to command or control the fight. The defense became static and inflexible. Battalion and regimental commanders could not influence the fight with their organic heavy weapons, artillery or reserves. The regimental and battalion commanders' ignorance about the situation gave the division commander a false sense of security and denied him the ability to influence the fight. As the Germans began to penetrate the defenses, stragglers began to

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26 Robert Doughty, *The Breaking Point: Sedan and the Fall of France, 1940*, (Hamden: Archon Book, 1990), pages 170-171.

move to the rear spreading false information that German tanks were across the river. The commanders could not verify or deny this information spread by the stragglers since they had lost contact with the defending units. The result was that panic spread in the rear areas of the regiments and the division causing the division's defense to disintegrate. The breakdown of the French command, control and communication system at all echelons prevented their visualization of the battlefield. This in turn denied them the ability to describe what was occurring on the battlefield to themselves or their higher headquarters. The inability to receive information for timely decision-making and to visualize the battle prevented their ability to direct or control the conduct of the battle or apply combat power at critical locations during the fight.

Through the failure of the French communication system and the resulting paralysis of their ability to command and control, the Germans gained a significant advantage. Compounding this advantage was the German's system of the integrating the radio as an asset of their command and control system. [27]

Integration of the radio allowed commanders to fight from the front. The radio facilitated the German commanders at all echelons. It provided them the flexibility and ability to change the plan to accomplish their mission and to meet their higher commanders' intent. Based on personal observations with the fighting soldiers and radio reports from subordinate elements the commander constantly reassessed the battle. This in turn allowed him to redirect rapidly assets and forces as required to accomplish the mission. The commander using

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[27] Ibid., pages 30-32.

the radio informed his higher headquarters through the staff. The staff members

in turn informed the commanders about the "big picture" as the adjacent and

echelons of command exchanged information. The German command and

control system allowed the commander to remain linked to his command post

and subordinate units. The radio allowed him to maintain his situational

awareness, receive information necessary to make decisions and direct the

actions of his unit. The German system was proactive and did not limit the

commander's ability to lead while the French command and control system

limited their commanders.

At the end of World War II, the industrial nations of the world were able to

field large complex military organizations supported by an extensive industrial

and economic base. 28 The complexity associated with these organizations

required larger volumes of information. The need for information to mobilize,

employ and sustain a post-World War II military organization permanently linked

the ability of the commander to communicate to his ability to command and

control. The lesson of World War II was that the function of command and

control was the glue that held a unit together. In addition, the notion that the

commander could stay in his command post and send instructions electronically

to his subordinates was not possible any longer. 29 The commander and his

staff that could receive data and information analyze and disseminate it faster

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28 Van Creveld, *Technology and War: From 2000 BC to the Present*, pages 235-236.

29 James Dunnigan, *Digital Soldiers: The evolution of High-Tech Weaponry and Tomorrow's Brave New Battlefield*, (New York: St. Martin's Press, 1996), pages 214-215.

than their enemy has a significant advantage. The United States Army's focus since World War II has been the integration of new technology to automate the battlefield to increase the lethality and precision of weapons. Beginning in the mid-1970's the US military began to integrate the computer into its command and control system to enhance a commander's ability to receive and send information through a computer network. 30 The result of this work is the combination of the lethality of the industrial age force and the precision and speed of the microprocessor.

The Information Revolution (The Age of Automation) 31

Initially, the staff's use of computers was as an administrative tool was to process and manage data. The speed of the computer data processors allowed a staff to rapidly receive, prepare and send the large amounts of information. The ability of computers to process data and conduct calculations enhanced the ability of the staff to identify the logistic requirements necessary to support the commander's plan and sustain his fighting force during combat. Artillery units also used the processing power of the computer to calculate firing data allowing them to fire missions at a much higher rate than artillery units that did not have these ballistic computers. However, humans passed the results of the computer's work either face-to-face or by exchanging a computer disk. The

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30 Frank Barnaby, *The Automated Battlefield*, (New York: The Free Press, 1986), pages 143-144.

31 Crevald, *Technology and War: From 2000 BC to the Present*, pages 235-249.

introduction in the 1970s of the Internet allowed computer to talk to each other

through a network system. 32

This system allowed information and data processed by computers to travel

at the speed of light. This network had the same effect as the integration and

evolution from the messenger to the telegraph/telephone to the radio took the

message out of the hands of the human and placed it in the hands of a machine.

In the 1980's, the US Army began a revolution in military affairs (RMA) to evolve

and integrate the networking of computers to link command and control functions

and the Army's communication and intelligence systems to "digitize" the

battlefield. 33

According to the *Army Digitization Master Plan*:

Digitizing the battlefield is the application of technologies to acquire,
exchange and employ timely digital information throughout
battlespace, tailored to the needs of each decider (commander),
shooter and supporter. Digitization allows each soldier to maintain a
clear and accurate vision of the common battlespace necessary to
support planning and execution.
Digitization provides the warfighters a horizontally and vertically
integrated digital information network that supports warfighting systems
and assures command and control (C2) decision-cycle superiority.
The intent is to create a simultaneous, appropriate picture of the
battlefield from soldier to commander at each echelon. 34

The digital RMA is based on the premise that:

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32 Dunnigan, *Digital Soldiers: The Evolution of High-Tech Weaponry and Tomorrow's Brave New Battlefield*, pages 274-279.

33 Ibid., pages 290-291.

34 Department of the Army, *Army Digitization Master Plan (ADMP)*, page 2; available from http://www.ado.army.mil/Br&doc/docs/ADMP/admpframes.htm; Internet; accessed 9/15/99.

− Improvements in computers and electronics will continue to improve weapons technology, communications, information processing and information networks.

− Sensors will become radically more capable leading to the transparency of the battlefield.

− Weapon systems and platforms will increase their effectiveness and efficiency making military forces more deployable and lethal. 35

The exploitation and integration of these factors into military organizations and tactics will have the same effect on the advancement of warfare as blitzkrieg in the 1930s and atomic weapons in the 1940s. Combined these factors will provide the Army "dominant battlefield knowledge," the ability to conduct "dominant maneuver" and ability to conduct "precision strikes" from long range. In the book *Technological Change and the Future of Warfare* Michael O'Hanlon, a senior fellow in Foreign Policy Studies at the Brookings Institution, presents four possible schools of thought guiding the direction of this RMA. 36

The first is the "system of systems." The potential of improving and integrating computers and communications into a network will make weapon systems function in a more integrated and therefore efficient manner. This will make the weapons systems more precise and more lethal leading to smaller tactical units that cover larger amounts of terrain. The "systems of systems" is

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35 Michael O'Hanlon, *Technological Change and the Future of Warfare*, (Washington D.C.: The Brookings Institution, 2000), pages 2-3.

36 Ibid., pages 11-18.

the "foundation of digitization" (37) that combines the functions of command and control with the ability to communicate enhanced by the speed of the computer network to process data and display the information. This system combines command, control, and communications and computers (C4) into an information network.

The second is the school of "dominant battlefield knowledge." This school combines the attributes of the "system of systems" school of thought with the improvements in sensors to provide better and more accurate information. The basis for this school of thought is that there will continue to be breakthroughs in the area of C4 systems. In addition, the intelligence, surveillance and reconnaissance (ISR) sensors that provide the data and information for the C4 system on the battlefield will improve radically in the next ten to twenty years. This school assumes that the speed of data processing and information sharing provided by the C4 system combined with the ISR system is the basis for the RMA in the form of C4ISR. Admiral William Owens in *Lifting the Fog of War*, refers to C4ISR as the "eyes and ears" of the military and is controlled by a single military organization. 38 All military units, through their internal collection assets, feed into this system and are capable of seamlessly receiving information in their battlespace from their internal and other external assets outside to support the commander's mission.

The third school of thought is called "global reach, global power." This school

37 Department of the Army, *Army Digitization Master Plan*, page 2.

38 William Owens, *Lifting the Fog of War*, (New York: Farrar, Straus and Giroux, 2000), page 205.

of thought adds to the capabilities of the combined C4ISR system of the previous two schools with the ability to project combat power outside the United States. This combines the information management flow and efficiencies of C4ISR network with lighter more deployable weapon systems. These weapons are longer ranged, more lethal through precision guidance and physically and logistically more deployable. This is the direction of the RMA and the foundation of the Army's plan to transform itself from the Army of Excellence used in the Cold War and Desert Storm to the Objective Force of 2020. 39

The final school of thought is the "vulnerability" school. This school of thought proposes that future enemies, even the much less wealthy or technologically sophisticated, will benefit from the new technology in weapons, computers and communications. If the United States does not change the way it fights and conducts battles, our future enemies will take advantage of the availability of this new technology. This will expose our military forces to unnecessary risks in a future conflict and challenge our forces more effectively than the Iraqis did during the Gulf War. 40 This school of thought attacks the notion that the United States is invulnerable as a military force and as a nation. This fear of needless casualties by an enemy gaining a asymmetric advantage over the United States by some new technology and the requirement to change the military now that the Cold War is over is pushing the need to change.

The Army is changing the way it fights battles and conducts engagements.

39 Louis Caldera and Eric Shinseki, "Army Vision," *Military Review*, Sept-Oct 2000, pages 3-5. Available at http://www.cgsc.army.mil/MilRev.

40 O'Hanlon, *Technological Change and the Future of Warfare*, page 3.

The basis for this change is the systems that enable the flow of information to occur between the echelons of command. Information is more critical now than it has been in the past to fight and win a battle. Although the C4ISR system is the enabler and the structure for the information to move between commands, fundamental functions of the commander have not changed since the end of World War II.

CHAPTER TWO:

BATTLE COMMAND AND STAFF CONTROL: THE ART AND SCIENCE OF WAR

"Decisions in war are difficult. More often than not, they must be made in obscure and uncertain situations. Frequently the time at which a decision should be made presents a greater problem than the decision itself."

INFANTRY IN BATTLE 41

"The most difficult but also most crucial part of a commander's varied duties is the making of a decision"

LOTHAR RENDULIC 42

An essential element of future military operations is the ability to gather, analyze and disseminate enormous amounts of data and information between echelons of command. The military organization must protect this ability and deny the enemy their ability to process data and information throughout their command structure. Meeting these conditions is an initial condition that allows the friendly unit to operate in an environment of information superiority relative to the enemy. 43 To guarantee information superiority the friendly unit must know what data and information is relevant, collected by the C4ISR system, to integrate it into the plan.

The combining of the components of the C4ISR system by the commander

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41 George Marshall, "Infantry in Battle," *The Infantry Journal Incorporated 2nd. Ed.*, 1 September 1938 (CSI Reprint, CGSC Fort Leavenworth, KS 1993), page 122.

42 Lothar Rendulic, *The Command Decision*. School of Advanced Military Studies: Military Theory Readings, (Fort Leavenworth: USA Command and General Staff College, 1999/2000), page 1.

43 Department of the Army, *ST 3-0 Operations*, pages 11-4 through 11-5.

and his staff is the foundation necessary to meet this condition. C4ISR is a combination of several elements and functions. ISR is the physical hardware or elements that collect data and information for the commander. The communications element is the system that allows the data and information collected by ISR assets to flow between echelons of command. The computer element or network stores processes and displays the data and information to develop a common operational picture and a shared understanding of the commander's intent and vision and the battlespace for the operation. The command function conducts the art of command by assimilating information to visualize the operation, describe his intent and vision and directing the actions of subordinate commands to achieve his endstate of the battle. 44 The staff function uses analysis, the automated information (computer) network and communication system by providing control of an operation to assist the commander in reaching his endstate. The staff uses scientific or empirical methods to monitor multiple statuses in order to compute requirements; analyze, measure and report on unit performance; identify variances for initial calculations; and correct deviations from the commander's guidance. 45 Therefore, the goal of C4ISR system is to allow the commander and his staff to gather information, develop a shared vision and understanding and to communicate it to his subordinate elements. The information system is a tool to assist the commander,

44 Ibid., page 5-2.

45 Department of the Army, *ST 100-9 The Tactical Decisionmaking Process*, (Fort Leavenworth: USA Command and General Staff College, 1 July 1993), page 1-3.

staff and subordinates in their ability to dictate the tempo of operations and to

impose the commander's will on the enemy.

The commander uses the concept of battle command to integrate the C4ISR

system with his staff and subordinate commands. *FM 101-5-1 Operational*

Terms and Graphics defines battle command as:

> The art of battle decision making and leading. It includes
> controlling operations and motivating soldiers and their organizations
> into action to accomplish missions. Battle command includes
> visualizing the current state and a future state, then formulating
> concepts of operations to get from one to the other at the least cost. It
> also includes assigning missions, prioritizing and allocating resources,
> selecting the critical time and place to act, and knowing how and when
> to make adjustments during the fight. 46

Battle command combines military art and science through the continual use of

the C4ISR system to provide and manage information to facilitate decision

making by the commander to achieve a desired endstate. The commander

formulates his vision, intent and concept of the operation through a process of

battlefield visualization.

According to *FM 101-5-1* battlefield visualization is:

> A process whereby the commander develops a clear understanding
> of his current state with relation to the enemy and environment,
> envisions a desired endstate, and then subsequently visualizes the
> sequence of activity that will move his force from its current state to the
> endstate." 47

Overall, the commander is responsible for the conduct and accomplishing the

mission. He must be able to visualize the sequence of events for his unit;

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46 Department of the Army, *FM 101-5-1 Operational Terms and Graphics*, (Washington D.C.: GPO, 30 September 1997), page 1-17. Also see Figure 5-1 "Visualize, Describe and Direct" in *ST 3-0 Operations*, page 5-4.

47 Ibid., page 1-34.

describe the sequence of the events to his staff and subordinates; and direct the actions of subordinates through personal leadership and decision making. Because of the amount of data available, the tempo and the complexity of modern military operations, it requires that the staff and subordinate commands understand the commander's vision and intent. By having, this shared vision the staff and subordinates will know what information is required or relevant and will be able to participate, effectively and efficiently, in the planning and execution of the mission.

The visualization for the commander begins at receipt of the mission by conducting an estimate of the operation. Based on several factors the estimate develops a common operational picture of the unit and its battlespace for the operation that the commander uses to develop his vision. These factors include:

– Personal knowledge of the situation.

– Personal experience and judgement.

– Assessments by his subordinate commanders.

– Staff estimates.

– Analysis of METT-TC. METT-TC is the <u>mission</u> given by his higher headquarters; <u>enemy</u> forces and their possible courses of action; the effects of <u>terrain</u> and weather on the operation; the <u>troops</u> and assets available for the operation; and any <u>civil</u> considerations that may effect the operation. 48

The commander describes his vision to the staff members and subordinate

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48 Department of the Army, *FM 101-5 Staff Organization and Operations*, (Washington D.C.: GPO, 31 May 1997), pages C-1 through C-3. Also, see *ST 3-0 Operations*, pages 5-4 through 5-6.

commanders through their intent and planning guidance. According to *ST 3-0 Operations*, commander's intent "is a clear, concise statement of what the force must do and the conditions the force must meet to succeed with respect to the enemy, terrain, and the desired end state." 49 Commander's intent is a personal expression of how the commander expects to win the battle. Intent and the mission statement focus the unit on the overall purpose of the operation. It is an expression of success for the unit and provides a framework for the unit in the absence of orders or additional guidance from the commander. Planning guidance is an additional expression of the commander's vision based on information available, personal experience and personal judgement. The planning guidance may be detailed or broad in nature but it provides the staff the latitude to plan and synchronize the assets of the unit for the battle. 50 To integrate C4ISR assets the commander's planning guidance provides the staff and subordinate commands the commander's critical information requirements (CCIR) for the mission.

According to *FM 101-5-1 Operational Terms and Graphics* CCIR is "the information required by the commander that directly affects his decisions and dictates the successful execution of operational or tactical operations." CCIR consists of three types of information requirements: priority information requirements (PIR), essential elements of friendly information (EEFI), and

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49 Department of the Army, *ST 3-0 Operations*, page 5-14.

50 Ibid.

friendly force information requirements (FFIR). 51

PIR are the "intelligence requirements for which the commander has anticipated and stated priority in his task of planning and decisionmaking." 52 Obtaining information that confirms or denies any of these intelligence requirements will cause the commander to make a decision. The use of PIR allows the staff to focus limited ISR assets on the events, locations and enemy forces that supports the commander's plan. EEFI are "critical aspects of a friendly operation that, if known by the enemy, would subsequently compromise, lead to failure, or limit success of the operation, and therefore must be protected from enemy detection." 53 The staff monitors and tracks the status of these pieces of information for the commander due to their criticality to the success of the operation. If the enemy detects any of these items, again the commander must make a decision on the conduct of the operation. FFIR is "information the commander and staff need about the forces available for the operation. This includes personnel, maintenance, supply, ammunition, and petroleum, oils and lubricants (POL) status and the experience and leadership capabilities." 54 FFIR are information on the status of items that will allow the units too physically accomplish the mission. The loss of any of these items or their drop below a specified level will require a decision by the commander for the conduct of the

51 Department of the Army, *FM 101-5-1 Operational Terms and Graphics*, page 1-34.

52 Ibid.

53 Ibid.

54 Ibid., page 1-72.

rest of the mission. The unit's mission, the commander's visualization and its

components of intent and planning guidance allow the staff to manage the data

and information sent to the command post through the C4ISR network.

The command post is the focal point of data and information that the

commander needs to command and control his unit. The staff must develop

procedures to mange the data in order to receive, analyze, display, distribute the

data as information, and monitor the conduct of the operation for the commander

as a controlling factor. 55 The staff is the enabler of the information

management process by using the C4ISR network. The network is the provider

of data but the staff is the element that turns it into information and makes it

relevant to the mission.

The definition of data sent to the command post over the network is "facts or

figures from which conclusions can be inferred." 56 The data received by the

network becomes the database for the staff to analyze, expand, update and

retrieve through the C4ISR system. The staff with the assistance of computers

processes the data and displays it in a useable format. At this point, the data

becomes information. 57 The displayed information becomes the common

operational picture (COP) for the commander; his staff and subordinate units.

55 Department of the Army, *FM 71-3 The Armored and Mechanized Infantry Brigade (Final Draft)*, (Washington D.C.: GPO, 1999), page I-4.

56 *Webster's New World Dictionary of the American Language: Second College Edition*, (New York: Simon and Schuster, 1982), page 360.

57 George and Meredith Friedman, *The Future of War: Power, Technology and American World Dominance in the Twenty-first Century*, (New York: St. Martin's Griffin, 1996), pages 379-385.

The COP is all the information available at any particular point in time on friendly

and enemy units displayed on a common map. At this point, the commander has

battlespace awareness. Through battlespace awareness, the commander knows

where everything is of military significance in his area of operation. However,

knowing where everything is on the battlefield requires further analysis by the

commander and staff to become knowledge. 58

   A scientific analysis of the capabilities, strengths, weaknesses and

vulnerabilities of friendly and enemy units is the first step in making information

into knowledge. The product of analysis at this point is intelligence. Intelligence

is the intellectualization of information to make it useful to solve a problem.

Analyzing the ability of a force, in a given amount of time and battlespace, to

conduct an operation makes the intelligence relevant to the commander, his staff

and subordinate units. Relevant intelligence is now knowledge because the

commander can use it to visualize the battle, develop intent and planing

guidance for his staff, direct the fight and conduct decisionmaking to accomplish

the mission. This process of converting data to knowledge is a constant one that

involves the commander, the staff and subordinate commanders. The C4ISR

system enables the data to flow rapidly through the network. The analysis and

the ability to communicate this knowledge faster than the enemy gives the

commander dominate battlespace knowledge. Dominant battlespace knowledge

allows the commander to rapidly and efficiently, through a combination of attrition

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58 Owens, *Lifting the Fog of War*, page 136.

and maneuver, to defeat an enemy force. 59 The use of precise attrition and

maneuver allows the commander to dominate his battlespace. Therefore, to

dominate battlespace the commander must have information dominance.

Digitization is the information network that provides the efficiency or the

information dominance that links the soldiers, weapons, sensors and

commanders into a synchronized fighting force. 60

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59 Ibid., pages 137-138.

60 Department of the Army, *Army Division XXI*, (Washington D.C.: GPO, 1998), page 22.

CHAPTER THREE:

DIGITIZATION, COMPLEXITY AND UNCERTAINTY

"What is needed is another quantum surge in force capability. Interoperable digitization of the battlefield has the potential to provide the means for the next renaissance of military art and science, in the same manner that the infusion of digital technology in the American society is providing a transitional bridge from the Industrial Age to the Information Age."

ARMY DIGITIZATION MASTER PLAN 61

Information and the sharing of information are only two of the essential elements necessary for success on the battlefield. Digitization is the latest tool to share information. Digitization is an enabler that links the commander, his staff and subordinate commands through technological means to begin the process that maintains and updates data on a constant basis. This capability allows the commander and his staff to receive and send large amounts of data.

The purpose of digitization is to enhance the ability of commanders and their staffs to share, store, analyze, display and disseminate data through the processing power of the computer. The knowledge gained through analysis of displayed data (information) gives the commander the relevant operational picture necessary for his visualization of the battlefield. 62 The digital system communicates this relevant picture to subordinate commanders to assist them in understanding and sharing the commander's vision. It also provides data for the staff to control the battle by developing plans, monitoring the unit many statuses and its ability to accomplish the mission. Additionally, the staff uses the digital

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61 Department of the Army, *Army Digitization Master Plan*, page 1.

62 Ibid., page 2.

system to manage the information necessary for the commander to make timely decisions. 63

Digitization establishes an information network that is capable of transmitting and sharing information across a dispersed battlefield. This network processes data and displays information to project a shared battlespace awareness and common knowledge of friendly units and known enemy forces conducting tactical military operations in a defined area of space. 64 The system presents the relevant operational picture throughout the chain of command. The network is the link between the sensor, the decision-maker and the weapon system or unit in an automated information loop. This capability shortens the amount of time that is required for a unit or weapon system to have the desired effect on an enemy formation or system. The focus for a digitized unit is now on the ability to mass effects against an enemy not the physical massing of combat units. Therefore, information is now a combat multiplier.

Using information as a combat multiplier requires that tactical unit operate in a new environment defined by two concepts. In *Network Centric Warfare* David Alberts, John Garstka and Frederick Stein define these concepts. 65 These concepts are dependent, not exclusive, of each other. The first concept is that

63 Department of the Army, *FM 71-100-5 EXFOR Division Operations Tactics, Techniques, and Procedures Version 3*, (Washington D.C.: GPO, June 1997), pages 2-4 through 2-6.

64 David Alberts, John Garstka and Frederick Stein, *Network Centric Warfare: Developing and Leveraging Information Superiority 2nd Edition (Revised)*, (Washington D.C.: National Defense University Press, 1999), pages 88 and 93-94.

65 Ibid., pages 90-93.

there is "effective linking" of all the information nodes in a unit's battlespace. Conceptually, this is the fundamental requirement for the sharing and dissemination of information and digitization. The effective linking of units requires a robust and high performance communications network that all units can access and exchange all available information. 66 The information that is exchanged is the scientific elements of battlefield visualization, the friendly and enemy situation, effects of the terrain, natural or man-made and noncombatant and environmental conditions. 67 The second concept is that units are "knowledgeable." Effective linkage between nodes is providing a constant flow of timely and accurate information and subordinates and staffs having a shared understanding and awareness of the battlespace and the commander's intent units possess battlefield information. 68 The analysis of the battlefield information using the experience, expertise and input from the commander, his staff and subordinate gives the unit battlefield knowledge for planning and execution of the battle.

The ability of a commander and his staff to operate within these concepts and to integrate the enhanced technology and functions of the C4ISR system enables them to reduce complexity. Reducing complexity is the ability of a system to reduce the effects of the enemy, time and space on the commander's ability to

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66 Ibid., page 90.

67 Department of the Army, *FM 71-100-5 EXFOR Division Operations Tactics, Techniques, and Procedures Version 3*, pages 2-2 through 2-3.

68 Alberts, Garstka and Stein, *Network Centric Warfare: Developing and Leveraging Information Superiority 2nd Edition (Revised)*, page 91.

effectively mass and maintain a higher tempo of operations relative to the enemy. The information that the commander receives is through a flattened organization that is available instantaneously in the network as opposed to the reporting system of the past.

People no longer limit the ability to send and receive information. Data entered into the network is not linear in nature. A lower headquarters does not receive the data from a sensor or an observer and then have to send it to the next higher level. Observations made and entered into the network are immediately available on the network. This allows each echelon to analyze the data and decide on what actions the information requires. The speed of the microprocessor and the hardware of the system become the limiting factor of the data flow not the ability of humans to receive and send the data. This increased speed in the flow of data will shorten the decision cycle of the commander. After conducting analysis of the information he can decide on the any necessary actions, orient or reorient his force rapidly and therefore gain an advantage over an opponent in time and space. 69 The information system acting in parallel instead of as a hierarchy and the speed of data movement throughout the network can reduce the complexity of the commander's decision cycle. The technology of the digital system allows data and information to travel rapidly throughout a unit but does it remove or reduce uncertainty on the battlefield?

Dr. Gary Klein in his book *Sources of Power* defines uncertainty as what we

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69 Department of the Army, *ST 6-0 Command and Control*, (Fort Leavenworth: USA Command and General Staff College, 31 August 2000), pages A-1 through A-3.

do not know or understand about a given situation. 70 The resulting doubt that

occurs threatens to block action because of the lack of information. For a military

organization, the subjects of the information are the enemy, the environment and

friendly forces. According to Dr. Klein, there are four sources of uncertainty:

   − The information is missing; unavailable or received but can not be located.

   − The information is unreliable; the credibility of the source is low or

   perceived as low even if the information is accurate.

   − The information is ambiguous or conflicting; there is more than one way to

   interpret the information.

   − The information is complex; it is difficult to integrate the many facets of the

   data and extrapolate meaning. 71

Within the context of the information about the enemy, the environment and

friendly force, there are three levels of uncertainty. 72 The first level of

uncertainty is about existing conditions (facts). The data that measures the

condition is factual or easy to measure but is difficult to collect. For example,

where is the enemy, with what equipment and what strength is he?   Until a

reliable sensor or observer answers these questions, there is uncertainty about

the information that is necessary to make a decision or act. The second level of

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70 Gary Klein, *Sources of Power: How People Make Decisions*,
(Cambridge: The Massachusetts Institute of Technology Press, 2000), pages
276-277.

71 Ibid., page 277. Also see John Schmitt and Gary Klein, "Fighting the
Fog of War: Dealing with Battlefield Uncertainty," *Marine Corps Gazette*, August
1996, page 63. Available at http://www.gazette@mca-marines.org.

72 Schmitt and Klein, "Fighting the Fog of War," page 64.

uncertainty is the knowledge gained by the analysis of data collected. Continuing with the example above; the commander may have the data that confirms and provides him with a reliable picture of the existing conditions in regards to the location of the enemy, his strength and the equipment he possess. Based on the facts the commander must infer what are the enemy commander's intentions, their readiness and their morale? The conclusion the commander makes about the enemy are uncertain because he cannot read the enemy commander's mind. He is not privy to the enemy commander's thoughts nor does he understand the way that the enemy commander thinks in military matters. The commander must rely on his experience and expertise to decide on what the enemy's intentions and capabilities are at that particular time. The third level of uncertainty is the level of understanding. Using the known facts and making reasonable inferences about what the facts mean, the commander will not be able to predict with certainty, the outcome or future of a battle. The commander will decide on a course of action, but an adaptable enemy will react in a way, not foreseen or considered possible, based on his experience and expertise. Historically, successful commanders have accepted the presence of uncertainty.

Based on their training, experience and expertise commanders concentrate on developing knowledge, understanding, and not overcoming the level of uncertainty because of a lack of data. 73 Data is a basis for the commander's knowledge and understanding of a military problem. Digitization uses the automated system to collect data and display the information at the speed of the

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73 Ibid.

computer's microprocessor. Analysis of the digitized information by the commander, his subordinate commanders and staff evolves the information into the battlefield knowledge necessary for decision-making. The commander's battlefield visualization and intent allows the echelons of command and staffs, using the digital network, to sort and sift through the increased amounts of information present in a digital unit. 74

The integration and use of digital technology has resulted in a data revolution and a command and control evolution. The higher collection rate of data and the computer networks ability to display a common understanding and operational picture will reduce some of the sources and levels of uncertainty.

The ability of the commander to use his training, experience and expertise to visualize the battlefield and translate that vision into intent and planning guidance will also eliminate uncertainty about what data and information is of value. This shared vision and understanding will focus his subordinates and staff to identify data that is relevant for decision-making and to assist him in the control of the battle. Without this the digital system will collect, store and process the data but the analysis that will turn it into knowledge will be lost. 75

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74 Ibid., page 66. Also see Klein, *Sources of Power*, page 279.

75 Ibid.

CHAPTER FOUR:

CONCLUSION

"… training in solving problems of all types, long practice in making clear, unequivocal decisions, the habit of concentrating on the question at hand and elasticity of mind are indispensable requisites for the successful practice of war."

INFANTRY IN BATTLE 76

"… the way to victory is known. Know the enemy and know yourself; in a hundred battles, you will never be in peril. When you are ignorant of the enemy but know yourself, your chances of winning or losing are equal. If ignorant both of your enemy and of yourself, you are certain in every battle to be in peril."

Sun Tzu 77

Historically, the requirement for information has always been present. To gain and distribute information military organizations have relied on the integration of many forms of technology. Technology is by definition an enhancement of man's ability to do something through artificial means. Digitization is the latest attempt to use technology to gain and distribute information.

Since the end of the Cold War, the United States Army conduct of its revolution in military affairs is to maintain military dominance through the integration of information technology. The purpose of the revolution is to use information technology to satisfy the needs of the US Army to maintain the asymmetric advantage demonstrated during Desert Storm. The issue for today's

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76 George Marshall, "Infantry in Battle," *The Infantry Journal Incorporated 2nd. Ed.*, 1 September 1938 (CSI Reprint, CGSC Fort Leavenworth, KS 1993), page 1.

77 Sun Tzu, *The Art of War*, page 84.

post-Industrial Age army is; can the digitization of the battlefield enable it to leverage the large amounts of data available to reduce complexity and uncertainty, while conducting and sustaining tactical operations? The answer to this question is yes. The main point of digitization is that it is an enabler for the commander to allow him to visualize, describe and direct tactical operations. Using a computer network and its supporting communication technology the digital unit can receive, transmit and store large amounts of data and display the data as information. 78 The information develops a common operational picture and a level of situational awareness by answering the following questions for the commander and his staff:

- − Where are my units?

- − Where are the friendly units to my front, left, right and rear?

- − Where are all the known enemy units in my area of interest?

The answering of these three questions by the information system allows the commander to concentrate on developing knowledge, understanding to fight an enemy force, and not on gathering data about himself and the enemy. 79

All the sensors operating in his area of operations, automatically and instantaneously, provide him, his subordinates and staff this information. With the digital system, displaying the answer to these questions and continually updating their statuses, the commander begins conducting analysis of the

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78 Robert Leonhard, *The Principles of War for the Information Age*, (Novato: Presidio Press, 1998), page 14.

79 Schmitt and Klein, *Fighting in the Fog*, page 64.

situation based on facts as opposed to the ignorance. Therefore, the digital system will enable the commander and his unit to begin planning and operations in a more certain information environment.

Because the network is not hierarchical but flat in nature the receiving, storing, displaying and the dissemination of information by the system occurs at a more rapid pace than was possible in a non-digitized unit. The increased speed of the information loop allows the digital commander to observe his battlespace rapidly (visualize and describe) and orient his force efficiently (direct) as he commands and controls his tactical unit. 80 Therefore, the speed and parallels of the ISR network will decrease the complexity of the battlefield for the purposes of command and control. The commander and his staff will be able to concentrate on the analysis of information to allow the commander to decide on a particular course of action and direct the units action at a higher tempo. 81

The impact on the future of the U.S. Army is to concentrate and emphasis the integration of digital technology to answer the three questions listed above for the commander. The Army must develop through training leaders and staff members that can use the information of the digital network and conduct their analysis to support the commander's intent and planning guidance. The commander using the network, his years of experience and his expertise will be able to conduct his analysis and execute decision-making at a faster rate.   The staff and subordinate commanders with the commander's intent and guidance

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80 Department of the Army, *ST 6-0 Command and Control*, pages A-1 through A-3.

81 Ibid.

can concentrate on the analysis to support the commander's decision cycle instead of gathering and displaying of data as in a non-digitized unit. The Army must develop a leadership, training program that takes advantage of the information networks ability to gather, store, and display data at the speed of the microprocessor not at the rate of a human. This training will reduce the complexity and uncertainty of the tactical battlefield. This will allow the commander, his subordinates commanders and staff to concentrate on the analysis of information to make timely decisions and to conduct tactical operations in a more efficient manner.

This is how digitization will enable the U.S. Army to maintain its asymmetric advantage.

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